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Running head: BODY IMAGE AND DISORDERED EATING BEHAVIOURS

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The Relative Importance of Dissatisfaction, Overvaluation and Preoccupation with Weight
and Shape for Predicting Onset of Disordered Eating Behaviours and Depressive Symptoms
over 15 Years

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Abstract

Objective: The aim of this study was to examine the relative importance of dissatisfaction, overvaluation and preoccupation with body weight and shape in predicting increases in disordered eating behaviours and depressive symptoms from adolescence through to early adulthood.

Method: The study involved 1,830 participants (60% female) who completed the Project EAT survey during adolescence (mean age = 14.90 years, SD = 1.65 years) and again, 15 years later, in early adulthood. Participants provided assessments of dissatisfaction, overvaluation and preoccupation with weight and shape, as well as disordered eating and depressive symptoms at both time points.

Results: The three aspects of body image had distinct patterns of association with the outcomes both concurrently and longitudinally. Dissatisfaction predicted depressive symptoms as well as a wide range of disordered eating outcomes, including dieting, unhealthy weight control behaviours (UWCBs), and binge eating, particularly in female participants. Preoccupation was associated with all of these disordered eating behaviours (but not with depressive symptoms) and was notably the strongest predictor of dieting and UWCBs in female participants. Overvaluation was associated with both disordered eating and depressive symptoms, although typically was a less potent predictor of difficulties than the other aspects of body image.

Discussion: Dissatisfaction, overvaluation and preoccupation are related but make distinct contributions to clinically significant outcomes. Models of eating disorders should move beyond focusing exclusively on dissatisfaction or overvaluation towards a broader conceptualisation of body image. Findings from the current study particularly suggest the importance of considering preoccupation with weight and shape.

- 1 Keywords: body image, disordered eating, depression, weight and shape concerns,
- 2 longitudinal

The Relative Importance of Dissatisfaction, Overvaluation and Preoccupation with Weight and Shape for Predicting Onset of Disordered Eating Behaviours and Depressive Symptoms over 15 Years

Disturbances in body image are increasingly being recognised as a public health concern, being associated with poor quality of life (Griffiths et al., 2016) as well as increased risk for a range of difficulties, most notably eating disorders, but also depressive symptoms, overweight, and unhealthy weight control behaviours, such as cigarette smoking (Field et al., 2005; Loth, Watts, Van Den Berg, & Neumark-Sztainer, 2015; Patalay, Sharpe, & Wolpert, 2015; Rohde, Stice, & Marti, 2015; Sonnevile et al., 2012; Sonnevile et al., 2015). Despite the centrality of body image disturbances in models of risk and maintenance (e.g., Fairburn, Cooper, & Shafran, 2003; Stice, Gau, Rohde, & Shaw, 2017), and in diagnostic criteria for eating disorders (American Psychiatric Association, 2013), this construct remains relatively loosely conceptualised, with terms often used interchangeably, or captured under umbrella concepts, such as ‘weight and shape concerns’ (e.g., La Mela et al., 2015; Murphy, Dooley, Menton, & Dolphin, 2016).

Body image is a broad ranging construct spanning perceptual, attitudinal and behavioural components (Thompson, 2004). Three distinct aspects of body image have been of particular relevance to aetiological and diagnostic models of eating disorders, namely: dissatisfaction, preoccupation, and overvaluation of weight and shape. Dissatisfaction refers to the negative affective appraisals of one’s body. Preoccupation refers to frequent, repetitive and intrusive thoughts about one’s body. Finally, overvaluation refers to the body’s weight and shape playing an overly important role in the person’s perceived self-worth.

Whilst body image disturbance is recognised as being a central diagnostic feature of a number of different disorders, disparate aspects are emphasised across disorders. For

example, in Anorexia Nervosa and Bulimia Nervosa, the focus is exclusively on overvaluation, with DSM-5 diagnostic criteria including “undue influence of body shape and weight on self-evaluation” (American Psychiatric Association, 2013). In contrast, the key criterion in Body Dysmorphic Disorder, is ‘preoccupation’; explicit reference to ‘preoccupation’ was present in Pope’s provisional criteria for Muscle Dysmorphia (Pope Jr, Gruber, Choi, Olivardia, & Phillips, 1997) and underpins the DSM-5 criteria for the Muscle Dysmorphia specifier of Body Dysmorphic Disorder. Currently the diagnostic criteria for Binge Eating Disorder do not refer to body image concerns, but the utility of including overvaluation as a criterion or specifier has been the topic of ongoing debate (e.g., Grilo, 2013; Harrison, Mond, Rieger, Hay, & Rodgers, 2015; Mitchison, Rieger, et al., 2017).

Aetiological and maintenance models of eating disorders show a similar picture. For example, the transdiagnostic model explicitly places “over-valuation of eating, weight and shape and their control” at the heart of the maintenance model, but does not refer to dissatisfaction or preoccupation (Fairburn et al., 2003). By contrast, models of body dysmorphic disorder (e.g., Veale, 2004) explicitly refer to dissatisfaction (i.e., negative appraisals), indirectly refer to preoccupation (i.e., rumination), and do not mention overvaluation. Furthermore, sociocultural models of eating disorders, such as the Tripartite Model (Keery, Van den Berg, & Thompson, 2004) and the Dual Pathway Model of Bulimia Nervosa (Stice, Ziemba, Margolis, & Flick, 1996), tend to focus on body dissatisfaction, without reference to preoccupation or overvaluation.

Body image difficulties have also been implicated as a shared risk factor between eating disorders and depressive disorders, being one explanation for their high co-morbidity and their gendered presentation (Ferreiro, Seoane, & Senra, 2014). The gender additive model of depression hypothesises that the stark gender differences in prevalence rates of depressive symptoms can be partially explained by body image and eating-related risk that is

1 disproportionally potent for girls compared with boys (Bearman & Stice, 2008). Whilst the
2 model refers to body image more generally, the focus has exclusively been on body
3 dissatisfaction when testing this hypothesis (Bearman & Stice, 2008; Ferreira et al., 2014).

4 Whilst different aspects of body image have independently been associated with
5 outcomes of clinical interest, what is less clear is the *unique* predictive power of
6 dissatisfaction, overvaluation and preoccupation for the development of these difficulties. A
7 small body of work has begun to show that different aspects of body image disturbance do
8 indeed have unique predictive power. For example, in pre-adolescents, Allen, Byrne,
9 McLean, and Davis (2008) found that dissatisfaction, but not overvaluation, predicted
10 increases in dietary restraint. Similarly, Ricciardelli, McCabe, Holt, and Finemore (2003)
11 found that body dissatisfaction but not ‘importance’ of weight (i.e., a construct akin to
12 overvaluation) predicted use of strategies to lose weight in preadolescents, and, conversely,
13 the ‘importance’ of muscles but not body dissatisfaction predicted use of strategies to
14 increase muscles. In an adult female sample, Mond and Hay (2011) considered the interplay
15 between dissatisfaction and overvaluation, and reported that dissatisfaction in combination
16 with overvaluation was associated with the most severe eating pathology. As such, there is
17 growing evidence that these body image constructs, while correlated (Mitchison, Hay, et al.,
18 2017), may have distinct predictive power. As such, by focusing on particular aspects of body
19 image in isolation, important risk pathways and interactions may have been overlooked.

20 In recent work, Mitchison, Hay, et al. (2017) provided a more comprehensive
21 examination of these dimensions of body image through examining dissatisfaction,
22 overvaluation and preoccupation concurrently in an adolescent population. In addition to
23 looking at associations with disordered eating symptoms, this work examined links with
24 psychological distress, in the form of depressive symptoms. Psychological distress is one of
25 the DSM criteria (alongside impairments in functioning) for clinically significant difficulties,

thus providing a further indicator of importance of body image for outcomes of clinical interest. The study found that in adolescent girls, preoccupation was more strongly correlated with both psychological distress and disordered eating than dissatisfaction or overvaluation, whereas the three constructs were more equivalent in boys. The cross-sectional nature of this study meant that it is not possible to untangle the directionality of these associations, but the work does suggest that it would be beneficial to take a more holistic approach to the conceptualisation of body image.

In light of these findings, longitudinal work is a valuable next step in untangling the relative importance of different aspects of body image in predicting onset of clinically significant difficulties. Therefore, the research question being addressed in this paper is: what is the relative importance of dissatisfaction, overvaluation and preoccupation with body weight/shape in longitudinally predicting increases in disordered eating behaviours and depressive symptoms from adolescence through to early adulthood? The findings have potential implications for diagnostic criteria for eating- and body image-related disorders and for aetiological models of these.

Method

Study Design and Population

Data for this analysis were drawn from the population-based, Project EAT (Eating and Activity in Teens and Young Adults) longitudinal study of dietary intake, physical activity, weight control behaviours, weight status, and factors associated with these outcomes among young people. The sampling procedure for Project EAT-I (Time 1) has been previously published (Neumark-Sztainer, Croll, et al., 2002; Neumark-Sztainer, Story, Hannan, & Croll, 2002). In brief, middle school and high school students at 31 public schools in the Minneapolis-St. Paul metropolitan area of Minnesota completed surveys and

anthropometric measures during the 1998-1999 academic year (Neumark-Sztainer, Croll, et al., 2002; Neumark-Sztainer, Story, et al., 2002). Project EAT-IV (Time 4) was designed to follow up on the original participants in 2015-2016 as they were progressing through young adulthood. The analytic sample included 1,830 participants who responded to the Time 4 survey.

Invitations to complete the EAT-IV survey were mailed along with a two-dollar bill to all participants in the original assessment who had responded to at least one previous follow-up survey (Time 2 and/or Time 3, N = 2770). Survey invitation letters provided the web address and a unique password for completing the online version of the Project EAT-IV survey. To enhance participant response, a combination of U.S. mail, email, and text message reminders were sent to non-responders. Participants were mailed a financial incentive and entered in a raffle draw following survey completion. Data collection ran from January 2015 to May 2016 and was conducted by Wilder Research in St. Paul, Minnesota (<http://www.wilderresearch.org>). The University of Minnesota's Institutional Review Board Human Subjects Committee approved all protocols used in Project EAT at each time point.

A total of 788 males and 1,042 females completed Project EAT-IV surveys that were determined to be valid and adequately complete for inclusion in analyses, representing 66.1% of participants who were invited to complete surveys. Most survey respondents (95.4%) completed the online survey and completers took an average of 40 minutes to answer the questions. Respondents had a mean age of 31.0 ± 1.6 years at Time 4.

Survey development

To allow for longitudinal comparisons and examination of secular trends, key items from Project EAT-I surveys were retained in the Project EAT-IV survey. Scale psychometric properties were examined in the full EAT-IV survey sample and estimates of item test-retest reliability, reported below, were determined in a subgroup of 103 participants who completed

the EAT-IV survey twice within a period of one to four weeks. Additional details of the survey development process are described elsewhere (Larson, Neumark-Sztainer, Story, van den Berg, & Hannan, 2011).

Measures

Body image. *Dissatisfaction* was assessed with a modified version of the Body Shape Satisfaction Scale (Pingitore, Spring, & Garfieldt, 1997). Each respondent assessed their current satisfaction with 10 different aspects of their body (height, weight, body shape, waist, hips, thighs, stomach, face, body build, shoulders) by responding on a five-point Likert response scale ranging from “very dissatisfied” to “very satisfied”. The test-retest reliability of this measure ranges from $r = 0.73$ in males to $r = 0.85$ in females, and the internal consistency is excellent (males: $\alpha = 0.92$; females: $\alpha = 0.92$). *Overvaluation* was assessed using the item “During the past six months how important has your weight or shape been in how you feel about yourself?” Participants responded on a four-point scale ranging from “not very important” to “the most important”. This measure has a test-retest reliability ranging from $r = 0.64$ (females) to $r = 0.75$ (males). *Preoccupation* was assessed using two items focused on rumination, and frequent repetitive thoughts about weight and shape. These were “I am worried about gaining weight” and “I think a lot about being thinner”. In each case participants responded on a four-point scale ranging from “strongly disagree” to “strongly agree”. This two-item scale has good internal consistency (males: $\alpha = 0.84$; females: $\alpha = 0.83$) and test-retest reliability (males: $r = 0.71$, females $r = 0.69$). These items closely resemble items from the Eating Disorder Examination-Questionnaire (Fairburn & Beglin, 2008) that have been used to examine overvaluation and preoccupation in previous studies (e.g., Mitchison, Hay, et al., 2017; Mond & Hay, 2011). Dissatisfaction was rescaled to have a maximum value of 4 and a minimum value of 1, so as to be comparable to the other body image variables.

Disordered eating. *Chronic dieting* was examined using the item “How often have you gone on a diet during the last year? By ‘diet’ we mean changing the way you eat so you can lose weight.” Participants responded on a five-point scale from “never” to “I am always dieting”. In the current study, participants were defined as experiencing chronic dieting if they reported dieting five times or more per year (males: test-retest agreement = 94%; females: test-retest agreement = 95%). Participants were defined as experiencing *unhealthy weight control behaviours* (UWCBs) if they endorsed using at least one of the following in the past year to lose weight or keep from gaining weight: fasting, eating very little food, taking diet pills, making themselves vomit, using laxatives, using diuretics (water pills), using food substitute (powder/special drink), skipping meals, smoking more cigarettes (males: test-retest agreement = 94%; females: test-retest agreement = 82%). *Binge eating with loss of control* was determined by participants responding ‘yes’ to both of the following questions: “In the past year, have you ever eaten so much food in a short period of time that you would be embarrassed if others saw you (binge eating)?” and “During the times when you ate this way, did you feel you couldn’t stop eating or control what or how much you were eating?” (males: test-retest agreement = 92%, females: test-retest agreement: 91%).

Depressive symptoms. *Depressive symptoms* were assessed with the six-item Depressive Mood Scale (Kandel & Davies, 1982). The measure includes items about the following symptoms: feeling too tired to do things, having trouble going to or staying asleep, feeling unhappy, sad or depressed, feeling hopeless about the future, feeling nervous or tense, and worrying too much about things. Respondents indicate how much they have been troubled by these symptoms in the last 12 months on a 3-point scale from “not at all” to “very much”, and item responses were summed resulting in higher scores indicating greater depressive symptoms. The test-retest reliability of this measure ranges from $r = 0.75$ (in females) to $r = 0.79$ (in males) and the internal consistency is good (males: $\alpha = 0.84$; females

$\alpha = 0.84$). This scale has also been shown to have good concurrent validity, correlating with the depressive mood subscale of the Symptom Checklist-90 and also distinguishing between adolescents referred to a psychiatric clinic who did or did not receive a diagnosis of a major depressive illness (Kandel & Davies, 1982).

Demographic and anthropometric control variables. Participants provided self-reported weight and height, from which BMI was calculated using the standard method (weight in kg/height in m²). Self-reported weight and height were compared to objective weight and height measured by research staff for all participants in adolescence and for a subsample of participants ($n = 125$) in young adulthood. In both instances, the correlation between self-report and objective measures was very good ($r = 0.80 - 0.98$) (Himes, Hannan, Wall, & Neumark-Sztainer, 2005).

Gender, ethnicity/race, and socio-economic status (SES) were based on Time 1 youth self-report. Ethnicity/race was categorized as White, African American, Asian American, Hispanic, Native American, or mixed/other. Five levels of SES were based on highest educational attainment by either parent. Data on eligibility for public assistance and free/reduced price school lunch and parental employment status were used to infer SES if parental education was not available (Neumark-Sztainer, Story, et al., 2002).

Analyses

Following examination of descriptive statistics and within time correlations, the research questions were explored using a series of logistic regression models for binary outcomes (dieting, UWCB, binge eating) and linear regression models for continuous outcomes (depressive symptoms). First, models were constructed to predict each outcome at Time 1 from the three body image variables at Time 1 (dissatisfaction, preoccupation and overvaluation). All body image variables were entered together to determine the unique predictive power of these related constructs. Univariate models are included in

Supplementary Materials, Tables S1 and S2, for comparison. Second, models were constructed to predict each outcome at Time 4 from the three body image variables at Time 1 and the outcome at Time 1, meaning that these models show the relative role of each aspect of body image disturbance in predicting *changes* in the outcome over time, over and above any concurrent associations between predictors and the outcome at Time 1. In the logistic regression models, this is equivalent to predicting *onset* of the behavior. All models were adjusted for key demographic variables: baseline BMI, age, ethnicity and SES. Across all models the variance inflation factors (VIF) were <1.6, demonstrating that collinearity between the body image variables was not a concern (Hair, Black, Babin, & Anderson, 2010).

Weighting and sample demographics

Because attrition from the original school-based sample did not occur at random, in all analyses, the data were weighted using the response propensity method (Little, 1986). Response propensities (i.e., the probability of responding to the EAT-IV survey) were estimated using a logistic regression of EAT-IV response (yes/no) on a large number of predictor variables from the school-based survey. The weighting method resulted in estimates representative of the demographic make-up of the original school-based sample, thereby allowing results to be more fully generalizable to the population of young people in the Minneapolis-St. Paul metropolitan area in 1998-1999.

Results

Descriptive statistics

Descriptive statistics for the key study variables are shown in Table 1. Female participants reported greater body image difficulties across dissatisfaction, overvaluation and

preoccupation compared with male participants at both time points. Similar gender differences were seen for depressive symptoms and disordered eating behaviours.

The three body image constructs were all positively correlated with each other at Time 1 (all $p > 0.001$). For female participants, these correlations were moderate to large in size (dissatisfaction-overvaluation: $r = 0.41$; dissatisfaction-preoccupation: $r = 0.60$; overvaluation-preoccupation, $r = 0.51$); for male participants, these were small to moderate in size (dissatisfaction-overvaluation: $r = 0.17$; dissatisfaction-preoccupation: $r = 0.38$; overvaluation-preoccupation, $r = 0.27$).

Cross sectional associations between adolescent body image and disordered eating/depressive symptoms

Logistic and linear regression models examining cross sectional associations between body image, disordered eating (dieting, UWCBs, binge eating) and depressive symptoms at Time 1 are presented in Table 2. It was notable that the three body image constructs were differentially associated with the four outcomes. First, overvaluation was concurrently associated with greater odds of dieting and using UWCBs and greater depressive symptoms in both male and female participants, but there was no association between overvaluation and binge eating in either group. Preoccupation, in contrast, was concurrently associated with increased odds of each of the three disordered eating outcomes, but not with increased depressive symptoms. It was also notable that preoccupation was a stronger predictor of dieting and (in female participants) UWCBs than the other aspects of body image difficulties. Finally, dissatisfaction was concurrently associated with all four outcomes in female participants, but only with greater odds of UWCBs and greater depressive symptoms in male participants.

Longitudinal associations between adolescent body image and changes in disordered eating/depressive symptoms over 15 years

Table 3 shows how the three body image constructs in adolescence predicted increases in disordered eating/depressive symptoms over the 15-year follow up period. These models show greater differentiation between the different aspects of body image regarding their pattern of association with the outcomes, as well as more notable differences in these patterns between the male and female cohorts.

In contrast to the cross-sectional models, overvaluation during adolescence predicted increased odds of reporting onset of binge eating into adulthood in both males and females. In line with the cross-section models, preoccupation predicted increased odds of beginning to diet in both male and female participants, as well as the increased odds of beginning to use UWCBS in males. Moreover, dissatisfaction predicted increased odds or severity for a range of outcomes in females (UWCBS, binge eating and depressive symptoms). In male participants, however, dissatisfaction only predicted increases in depressive symptoms over the follow up period.

Discussion

This study aimed to explore the importance of dissatisfaction, preoccupation and overvaluation for predicting increases in disordered eating behaviours and depressive symptoms over time. Previous research has tended to examine these constructs in isolation meaning that their relative importance has yet to be fully explored. The results of the current study support a more fine-grained approach, revealing that, whilst related, particular aspects of body image are differentially associated with various outcomes of interest in the general population.

In female participants, dissatisfaction with weight and shape had the broadest ranging connection with other difficulties, being associated with all outcomes (dieting,

UWCBs, binge eating and depressive symptoms) concurrently during adolescence and also being associated with increases in UWCBs, binge eating and depressive symptoms into adulthood. In this sense, dissatisfaction seems to play a pervasive role across a range of negative outcomes for adolescent girls that persist into adulthood. It is notable that these associations are independent of other aspects of body image, meaning that, for females at least, dissatisfaction may be of importance even when other concerns, such as overvaluation of weight and shape, are present.

These findings regarding body dissatisfaction are in alignment with existing work showing that body dissatisfaction is a particularly important predictor of disordered eating in a range of populations from children through to young adults (e.g., Allen et al., 2008; Mond & Hay, 2011; Ricciardelli et al., 2003; Rohde et al., 2015). The pattern of findings are also in support of the focus of the gender additive model of depression on body dissatisfaction (Bearman & Stice, 2008), as the current study shows that body dissatisfaction is the aspect of body image disturbance that is most consistently associated with depressive symptoms. However, these findings do stand in contrast to those of Mitchison, Hay, et al. (2017), who found that dissatisfaction was not associated with psychological distress once the role of other aspects of body image (preoccupation, overvaluation) had been taken into account. One potential explanation is that while in the current study we measured general body dissatisfaction with a range of body parts (including height, face, shoulders, etc.), and overvaluation and preoccupation with weight and shape specifically; in the study by Mitchison, Hay et al. the measurement of all three constructs were weight and shape related, meaning dissatisfaction could potentially more easily be partialled out. It is also feasible that these differences represent a cohort effect (the cohorts are over 10 years apart), or cross-cultural variations in these associations.

1 In contrast to dissatisfaction, preoccupation with weight and shape was exclusively
2 associated with the disordered eating behaviours and not with depressive symptoms. This is
3 despite negative ruminative thinking being a core feature of depressive psychopathology
4 (Papageorgiou & Wells, 2003). Notably, preoccupation was a particularly potent predictor of
5 concurrent dieting and UWCBS in female participants, and, for both males and females, was a
6 unique predictor of onset of dieting into adulthood.

7 To some extent the specificity of the associations with preoccupation found in the
8 current study mirrors the results of Mitchison, Hay, et al. (2017). Although Mitchison, Hay,
9 et al. (2017) did not find an exclusivity of preoccupation's association with disordered eating
10 outcomes, they did find that preoccupation was the strongest independent predictor of dietary
11 restraint and binge eating, particularly in girls. Collectively, these results suggest that,
12 whereas the majority of models of eating disorders do not include preoccupation with weight
13 and shape, this aspect of body image may be important to incorporate. Given the relative
14 dearth of literature on preoccupation as a risk factor for disordered eating, this finding also
15 suggests that this may be a fruitful avenue to pursue. Other models of body image disorder,
16 such as for body dysmorphic disorder, posit preoccupation as a central marker of the illness.
17 Future research investigating the extent to which a model such as Veale's Cognitive
18 Behavioral Model of BDD (Veale, 2004) can explain eating disorder pathology may
19 highlight shared attributes between these distinct disorders of body image.

20 Finally, for both male and female participants overvaluation of weight and shape
21 was associated with a wide range of outcomes of clinical interest. Whilst a link with binge
22 eating was not present concurrently, this association emerged prospectively in that
23 overvaluation in adolescence predicted increased odds of starting to experience binge eating
24 over the 15-year follow up. This could be due to the relatively low prevalence of binge eating
25 during adolescence (especially in males), which increases as the sample come into early

adulthood. This finding aligns with other work suggesting that overvaluation may be of importance for binge eating and hence consideration of a diagnostic criterion or specifier regarding overvaluation in binge eating disorder is warranted (e.g., Mitchison, Rieger, et al., 2017). More generally, overvaluation is central to a number of aetiological, maintenance and diagnostic models of eating disorders (American Psychiatric Association, 2013; Fairburn et al., 2003), and the target of cognitive behaviours models of treatment (Fairburn et al., 2003). As such, it is perhaps surprising here that overvaluation was not a more potent predictor of clinical outcomes than the other aspects of body image. As per existing research, it may be that overvaluation in combination with dissatisfaction is particularly problematic (Mond & Hay, 2011). Nonetheless, the current study brings into question the exclusivity of the focus on overvaluation in these approaches.

Turning to future work, the within-time correlations in this study highlight that there may be gender differences not only in how these body image constructs relate to disordered eating behaviours but also in how they are related to each other. Future models could explore trajectories of how these experiences tend to co-occur and interact with each other (and other key variables of interest, such as BMI) over critical periods of development. This would include testing longitudinal mediation and moderation pathways, which may point to which aspects of body image may be most fruitfully targeted in prevention programmes for maximal downstream impact. Whilst the current study has focused on body image difficulties, there is growing evidence for the importance of positive body image (e.g., body appreciation, body acceptance, Tylka & Wood-Barcalow, 2015). Exploring the relative contribution of these positive constructs alongside dissatisfaction, overvaluation and preoccupation would be a valuable next step.

A potentially important clinical implication is the demarcation of distinct targets for therapy addressing body image difficulties, which may empower clinicians to deliver body

image therapy in a more targeted and systematic manner. In the longer term, dismantling randomised controlled trials could explore the relative effectiveness of focusing on different aspects (or combinations of aspects) of body image during treatment.

Strengths and limitations

A major strength of the current study is the long term follow up of participants from adolescence through to adulthood, providing the opportunity to look at onset of difficulties over a key developmental period (Arnett, 2000). This provides a substantial contribution to this body of literature, which to date has been largely cross sectional (Mitchison, Hay, et al., 2017). The large sample size also meant that the models had sufficient power to detect small effects, and the sample is weighted to be representative of the population from which it is drawn.

The most notable limitation is that, although the measures of overvaluation and preoccupation map closely onto the theoretical constructs, the items used in the current study have not been specifically validated for this purpose. Use of single/two item indicators, whilst often necessary in large scale surveys, do limit the extent to which complex constructs, such as these, can be fully operationalised. Previous studies have also relied on single/two item measures that face similar criticisms (Mitchison, Hay, et al., 2017; Mond & Hay, 2011). It is worth highlighting that our measure of preoccupation is relatively narrow in its focus (worrying about gaining weight / thinking about being thinner), which may limit its applicability to BDD, and to preoccupation around other aspects of body shape, such as muscularity or curviness. We further note that the lack of associations between preoccupation and depressive symptoms may be due to the extent of worrying that people have, and how they interpret the term “worry about weight” within a society in which weight concerns are rampant. Given the growing body of evidence for the theoretical and empirical distinction between different aspects of body image, the development and application of robust,

validated measures to fully capture these constructs in future work would be a valuable next step. It is important to highlight that the measures of disordered eating behaviours refer to the prevalence in the past year and so are not directly comparable to specific diagnostic criteria for eating disorders, which typically refer to the past four weeks. As such, future work within clinical populations would also contribute to our understanding of the role of different aspects of body image in the development of clinically significant difficulties.

Conclusions

To the best of our knowledge, this study was the first to examine prospective associations between dissatisfaction, overvaluation and preoccupation in adolescents and later disordered eating and depressive symptoms. The findings corroborate previous work, showing that whilst these constructs are correlated they do have distinct predictive power, and that examining them in isolation may miss unique contributions of each. In this sample, preoccupation seemed to be a more specific and potent predictor of disordered eating, whereas dissatisfaction was more generic in its associations. Overvaluation was linked with a range of outcomes, but the strengths of these associations did tend to be lower than might be anticipated given its centrality to key models of eating disorders. Given the importance of body image as a measure of quality of life and a predictor of various outcomes, a greater understanding of the measures used here, in addition to measures of positive body image (e.g., embodiment, body appreciation) is needed.

1 Table 1.

2 *Participant Characteristics at Time 1 and Time 4*

	Time 1			Time 4		
	Females M (SD)	Males M (SD)	$t(df), p$	Females M (SD)	Males M (SD)	$t(df), p$
Dissatisfaction [†]	2.4 (0.7)	2.0 (0.7)	$t(1720)=11.50, p<.0001$	2.5 (0.6)	2.2 (0.7)	$t(1757)=11.71, p<.0001$
Overvaluation [†]	2.3 (0.9)	1.9 (1.0)	$t(1673)=9.01, p<.0001$	2.4 (0.8)	2.0 (0.8)	$t(1766)=11.95, p<.0001$
Preoccupation [†]	2.8 (0.9)	2.1 (0.9)	$t(1817)=16.52, p<.0001$	3.1 (0.8)	2.5 (1.1)	$t(1580)=13.36, p<.0001$
Depressive symptoms [‡]	11.1 (2.5)	9.6 (2.8)	$t(1686)=11.26, p<.0001$	11.1 (2.8)	10.0 (3.2)	$t(1703)=7.77, p<.0001$
	Females % yes (n)	Males % yes (n)	$\chi^2(df), p$	Females % yes (n)	Males % yes (n)	$\chi^2(df), p$
Chronic dieting [§]	57% (497)	25% (233)	$\chi^2(1)=118.27, p<.0001$	67% (599)	45% (423)	$\chi^2(1)=60.20, p<.0001$
UWCB [§]	57% (501)	33% (301)	$\chi^2(1)=63.42, p<.0001$	56% (501)	39% (363)	$\chi^2(1)=36.57, p<.0001$
Binge eating [§]	11% (98)	3% (26)	$\chi^2(1)=16.44, p<.0001$	15% (135)	9% (85)	$\chi^2(1)=9.58, p=.0020$

3 [†]: range = 1-4, [‡] range = 6-18, [§] These are one-year prevalence estimates of these behaviours

1 Table 2.

2 *Multivariate Logistic and Linear Regression Models Examining Cross Sectional Associations for Male and Female Participants at Time 1*

Males								
Predictors	Dieting T1		UWCB T1		Binge eating T1		Depressive symptoms T1	
	OR	(95% CI)	OR	(95% CI)	OR	95% CI	Coef.	(95% CI)
Dissatisfaction	1.31	(0.95, 1.81)	2.17	(1.64, 2.86)	0.75	(0.36, 1.57)	0.82	(0.52, 1.11)
Overvaluation	2.05	(1.64, 2.57)	1.54	(1.28, 1.85)	1.09	(0.67, 1.78)	0.55	(0.35, 0.75)
Preoccupation	3.68	(2.79, 4.86)	2.09	(1.67, 2.61)	2.29	(1.25, 4.17)	0.13	(-0.11, 0.37)
Females								
	Dieting T1		UWCB T1		Binge eating T1		Depressive symptoms T1	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	Coef.	(95% CI)
Dissatisfaction	1.45	(1.05, 2.00)	1.62	(1.16, 2.25)	3.31	(2.02, 5.42)	1.17	(0.89, 1.45)
Overvaluation	1.51	(1.21, 1.90)	1.71	(1.36, 2.15)	1.14	(0.83, 1.57)	0.49	(0.29, 0.69)
Preoccupation	3.45	(2.65, 4.49)	3.30	(2.54, 4.28)	2.52	(1.61, 3.94)	0.09	(-0.13, 0.31)

3 *Note.* All models are adjusted for BMI, age, ethnicity and SES (coefficients for all covariates available upon request). Bold indicates $p < 0.05$.

1 Table 3.

2 *Multivariate Logistic and Linear Regression Models Examining Longitudinal Associations for Male and Female Participants between Time 1*
 3 *and Time 4*

Males								
Predictors	Dieting T4		UWCB T4		Binge eating T4		Depressive symptoms T4	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	Coef.	(95% CI)
Time 1 level of outcome	2.27	(1.51, 3.39)	2.16	(1.53, 3.06)	3.84	(1.15, 12.81)	0.27	(0.19, 0.35)
Dissatisfaction	1.05	(0.83, 1.33)	0.84	(0.66, 1.08)	0.82	(0.53, 1.27)	0.58	(0.26, 0.91)
Overvaluation	0.95	(0.80, 1.12)	0.94	(0.79, 1.11)	1.46	(1.10, 1.92)	-0.20	(-0.43, 0.02)
Preoccupation	1.33	(1.08, 1.64)	1.32	(1.08, 1.61)	0.84	(0.60, 1.20)	-0.11	(-0.38, 0.16)
Females								
	Dieting T4		UWCB T4		Binge eating T4		Depressive symptoms T4	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	Coef.	(95% CI)
Time 1 level of outcome	1.09	(0.75, 1.60)	1.84	(1.27, 2.66)	1.19	(0.66, 2.15)	0.14	(0.07, 0.21)
Dissatisfaction	1.05	(0.80, 1.37)	1.45	(1.11, 1.89)	1.62	(1.11, 2.36)	0.64	(0.30, 0.98)
Overvaluation	1.03	(0.85, 1.25)	1.05	(0.87, 1.27)	1.29	(1.00, 1.67)	-0.05	(-0.29, 0.18)
Preoccupation	1.62	(1.29, 2.04)	1.00	(0.80, 1.25)	1.05	(0.78, 1.40)	-0.19	(-0.45, 0.07)

1 *Note.* All models are adjusted for BMI, age, ethnicity and SES (coefficients for all covariates available upon request). Bold indicates $p < 0.05$.

2

3 *Table S1.*

4 *Univariate Logistic and Linear Regression Models Examining Cross Sectional Associations for Male and Female Participants at Time 1*

Males									
Model number	Predictor	Dieting T1		UWCB T1		Binge eating T1		Depressive symptoms T1	
		OR	(95% CI)	OR	(95% CI)	OR	95% CI	Coef.	(95% CI)
1	Dissatisfaction	2.83	(2.22, 3.61)	3.40	(2.67, 4.33)	1.43	(0.77, 2.63)	0.92	(0.65, 1.19)
2	Overvaluation	2.32	(1.94, 2.76)	1.88	(1.60, 2.20)	1.72	(1.13, 2.65)	0.71	(0.51, 0.91)
3	Preoccupation	5.37	(4.21, 6.85)	2.90	(2.41, 3.49)	3.41	(2.13, 5.42)	0.46	(0.25, 0.67)
Females									
		Dieting T1		UWCB T1		Binge eating T1		Depressive symptoms T1	
		OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	Coef.	(95% CI)
4	Dissatisfaction	4.19	(3.29, 5.33)	4.16	(3.27, 5.29)	4.83	(3.34, 6.98)	1.34	(1.12, 1.55)
5	Overvaluation	2.56	(2.14, 3.06)	2.94	(2.44, 3.55)	2.12	(1.67, 2.69)	0.84	(0.66, 1.01)
6	Preoccupation	4.59	(3.73, 5.63)	4.83	(3.91, 5.95)	3.78	(2.67, 5.35)	0.76	(0.60, 0.93)

5 *Note.* Bold indicates $p < 0.05$.

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2 *Table S2.*3 *Logistic and Linear Regression Models Examining Longitudinal Associations for Male and Female Participants Between Time 1 and Time 4*

Males									
Model number	Predictors	Dieting T1		UWCB T1		Binge eating T1		Depressive symptoms T1	
		OR	(95% CI)	OR	(95% CI)	OR	95% CI	Coef.	(95% CI)
1	Dissatisfaction	1.14	(0.92, 1.41)	0.97	(0.78, 1.21)	1.36	(0.97, 1.913)	0.80	(0.50, 1.11)
	Time 1 level of outcome	3.11	(2.23, 4.35)	2.81	(2.06, 3.83)	6.74	(2.68, 16.97)	0.23	(0.15, 0.31)
2	Overvaluation	1.02	(0.87, 1.19)	1.06	(0.91, 1.24)	1.49	(1.17, 1.89)	-0.07	(-0.29, 0.16)
	Time 1 level of outcome	3.28	(2.33, 4.63)	2.82	(2.08, 3.81)	5.82	(2.26, 14.96)	0.30	(0.22, 0.38)
3	Preoccupation	1.38	(1.15, 1.66)	1.47	(1.23, 1.74)	1.35	(1.04, 1.76)	0.35	(0.12, 0.59)
	Time 1 level of outcome	2.18	(1.52, 3.14)	2.12	(1.55, 2.89)	3.80	(1.54, 9.40)	0.26	(0.19, 0.34)
Females									
		Dieting T1		UWCB T1		Binge eating T1		Depressive symptoms T1	
		OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	Coef.	(95% CI)
4	Dissatisfaction	1.52	(1.21, 1.90)	1.55	(1.25, 1.93)	1.89	(1.42, 2.51)	0.54	(0.27, 0.81)

	Time 1 level of outcome	1.66 (1.20, 2.30)	1.88 (1.38, 2.57)	1.30 (0.75, 2.25)	0.12 (0.05, 0.19)
5	Overvaluation	1.26 (1.06, 1.49)	1.19 (1.01, 1.41)	1.49 (1.21, 1.83)	0.09 (-0.11, 0.30)
	Time 1 level of outcome	1.81 (1.32, 2.48)	2.15 (1.58, 2.94)	1.61 (0.94, 2.74)	0.16 (0.09, 0.23)
6	Preoccupation	1.64 (1.37, 1.96)	1.19 (1.00, 1.41)	1.44 (1.16, 1.79)	0.093 (-0.10, 0.29)
	Time 1 level of outcome	1.29 (0.91, 1.82)	2.05 (1.47, 2.87)	1.38 (0.81, 2.36)	0.16 (0.09, 0.23)

Note. Bold indicates $p < 0.05$.

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